Q.P. Code: 20HS0835 **R20**

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY :: PUTTUR
(AUTONOMOUS)
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QUESTION BANK (DESCRIPTIVE)

Subject with Code: PROBABILITY & STATISTICS(20HS0835) **Branches**: CSE, CSIT, CSE(AI&ML) & CSE(IoT&CS including BCT)

Year &Sem: I-B.Tech & II-Sem **Regulation:** R20

UNIT –I
PROBABILITY

1	a) A class consists of 6 girls and 10 boys. If a committee of 3 is chosen at random from the class, find the Probability that (i)3 boys are selected (ii)exactly 2 girls are selected	[L1][CO1]	**[6M]**
	b) If three coins are tossed. Find the probability of getting i) 3 heads ii) 2 heads iii) no heads.	[L1][CO1]	**[6M]**
2	a) Two cards are selected at random from 10 cards numbered 1 to 10. Find the probability that the sum is even if (i) The two cards are drawn together. (ii) The two cards drawn one after other with replacement.	[L5][CO1]	**[6M]**
	b) Determine (i) $P\left(B/A\right)$ (ii) $P\left(A/B^C\right)$ if A and B are events with $P(A)=\frac{1}{3}$, $P(B)=\frac{1}{4}$, $P(A\cup B)=\frac{1}{2}$.	[L5][CO1]	**[6M]**
3	a) In a certain town 40% have brown hair, 25% have brown eyes and 15% have both brown hair and brown eyes. A person is selected at random from the town. i) If he has brown hair, what is the probability that he has brown eyes also? ii) If he has brown eyes, determine the probability that he does not have brown hair?	[L1][CO1]	**[6M]**
	b) The probability that students A,B,C,D solve the problem are $\frac{1}{3}$, $\frac{2}{5}$, $\frac{1}{5}$ and $\frac{1}{4}$ respectively If all of them try to solve the problem, what is the probability that the problem is solved.	[L3][CO1]	**[6M]**
4	Two dice are thrown. Let A be the event that the sum of the point on the faces is 9. Let B be the event that at least one number is 6. Find (i) $P(A\cap B)$ (ii) $P(A\cup B)$ (iii) $P(A^c\cup B^c)$ (iv) $P(A^c\cap B^c)$ (v) $P(A\cap B^c)$	[L1][CO1]	**[12M]**
5	In a certain college 25% of boys and 10% of girls are studying mathematics. The girls Constitute 60% of the student body. (a) What is the probability that mathematics is being studied? (b) If a student is selected at random and is found to be studying mathematics, find the probability that the studentis a girl? (c) a boy	[L1][CO1]	**[12M]**
6	Two dice are thrown. Let X assign to each point (a,b) in S the maximum of its numbers i.e, X(a,b)= max (a,b). Find the probability distribution. X is a random variable with X(s)={1,2,3,4,5,6}. Also find the mean and variance of the distribution.	[L5][CO1]	**[12M]**

7	A random variable X has the following probability function X: 0	1	2	2K	3K	4	5	6	7 P(x): 0	K	2K	2K	3K	K^2	$2K^2$	$7K^2+K$ Determine (i) K (ii) Evaluate $P(X \geq 6)$ and $P(0<X<5)$ (iii) if $P(X \leq K)>1/2$, find the minimum value of K (iv) variance.	[L5][CO1]	**[12M]**
8	a) Find the mean and variance of the uniform probability distribution given by $f(x)=\frac{1}{n}$ for $x=1,2,...,n.$	[L1][CO1]	**[6M]**
	b) If a random variable has a Probability density f(x) as $f(x)=\begin{cases}2e^{-2x}, for\ x>0\\0, for x\leq 0\end{cases}$ Find the Probabilities that it will take on a value (i)Between 1&3 (ii) Greater than 0.5	[L1][CO1]	**[6M]**
9	A continuous random variable has the probability density function. $f(x)=\begin{cases}k\ x\ e^{-\lambda x}, \text{for } x\geq 0, \lambda>0\\0, \text{otherwise}\end{cases}$ Determine the constant K, find mean and variance.	[L5][CO1]	**[12M]**
10	Probability density function of a random variable X is $f(x)=\begin{cases}\frac{1}{2}\sin x, for\ 0\leq x\leq \pi\\0, elsewhere\end{cases}$. Find the mean, mode and median of the distribution and also find the probability between 0 and $\pi/2$.	[L1][CO1]	**[12M]**

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UNIT-II
PROBABILITY DISTRIBUTIONS

1	a) Derive mean and variance of Binomial distribution.	[L5][CO2]	**[6M]**
	b) 20% of items produced from a factory are defective. Find the probability that in a sample of 5 chosen at random (i) one is defective (ii) $p(1<x<4)$	[L1][CO2]	**[6M]**
2	a) Fit a Binomial distribution to the following frequency distribution: x: 0, 1, 2, 3, 4, 5 f: 2, 14, 20, 34, 22, 8	[L3][CO2]	**[6M]**
	b) The mean and variance of a binomial distribution are 4 and $\frac{4}{3}$. Find $p(X \geq 1)$.	[L1][CO2]	**[6M]**
3	a) Out of 800 families with 5 children each, how many would you expect to have (i) 3 boys (ii) 5 girls (iii) either 2 or 3 boys. Assume equal probabilities for boys and girls.	[L3][CO2]	**[6M]**
	b) Two dice are thrown five times. Find the probability of getting 7 as sum i) at least once (ii) $p(1<x<5)$	[L1][CO2]	**[6M]**
4	a) Derive mean and variance of Poisson distribution.	[L5][CO2]	**[6M]**
	b) If 2% of light bulbs are defective. Find the probability that (i) 2 defective items (ii) at least 3 defective items (iii) $P(2<x<5)$ in a sample of 100.	[L1][CO2]	**[6M]**
5	a) Fit a Poisson distribution to the following data x: 0, 1, 2, 3, 4, 5, Total f: 142, 156, 69, 27, 5, 1, 400	[L3][CO2]	**[6M]**
	b) If the mean of a Poisson distribution is 1.8 then find $p(X>1)$.	[L1][CO2]	**[6M]**
6	a) An insurance agent policies of 5 men all of identical age and good in health. The probability that a man of this age will be alive 30 years is 2/3. Find the probability that in 30 years. (i) At least one man (ii) Atmost three will be alive	[L1][CO2]	**[6M]**
	b) If X is a Poisson variate such that $3P(X=4)=\frac{1}{2}P(X=2)+p(X=0)$, find (i) the mean (ii) $P(X \leq 2)$	[L3][CO2]	**[6M]**
7	Derive mean and variance of Normal distribution.	[L5][CO2]	**[12 M]**
8	In a sample of 1000 cases, the mean of certain test is 14 and standard deviation is 2.5.Assuming the distribution to be normal find (i) How many students score between 12 and 15 (ii) How many students score above 18? (iii) How many students score below 8?	[L3][CO2]	**[12 M]**
9	If the masses of 300 students are normally distributed with mean 68kgs and standard deviation 3kgs.How many students have masses i) Greater than 72kgs ii) Less than or equal to 64kg iii) Between 65 and 71 kgs inclusive.	[L3][CO2]	**[12 M]**
10	Find the mean and variance of a Normal distribution in which 7% of items are under 35 and 89% are under 63.	[L1][CO2]	**[12 M]**

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UNIT-III

BASIC STATISTICS

1 a) Find arithmetic mean to the following data using step deviation method

Marks	10-20	20-30	30-40	40-50	50-60
frequency	5	8	25	22	10

[L1][CO3] **[6M]**

b) Find the median to the following data ;

x	5	8	11	14	17	20	23
f	2	8	12	20	10	6	3

[L3][CO3] **[6M]**

2 a) Find the median to the following data ;

Class intervals	40-50	50-60	60-70	70-80	80-90
frequency	5	12	23	8	2

[L1][CO3] **[6M]**

b) Find arithmetic mean to the following data

X	1	2	3	4	5
F	5	8	10	12	6

[L3][CO3] **[6M]**

3 a) Find mode to the following data

X	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40
F	5	7	10	18	20	12	8	2

[L1][CO3] **[6M]**

b) The first four moments of a distribution about the value 5 of the variables are 2,20,40 and 50.Calculate mean, variance, β_1 and β_2 of the distribution.

[L5][CO3] **[6M]**

4 Compute Karl Pearson and Bowley's coefficient of Skewness to the following data ;

Class intervals	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
frequency	2	6	11	20	40	75	45	25	18	8

[L3][CO3] **[12M]**

5 Compute the first four central moments to the following data and also find Sheppard's correction, β_1 and β_2

Class intervals	0-10	10-20	20-30	30-40	40-50	50-60	60-70
frequency	2	8	12	40	20	15	3

[L3][CO3] **[12M]**

6 Calculate correlation coefficient to the following data [L5][CO3] **[12M]**

X	10	15	12	17	13	16	24	14	22	20
Y	30	42	45	46	33	34	40	35	39	38

7 Ten competitors in a musical test were ranked by the three judges A,B and C in the following order [L3][CO3] **[12M]**

Ranks by A	1	6	5	10	3	2	4	9	7	8
Ranks by B	3	5	8	4	7	10	2	1	6	9
Ranks by C	6	4	9	8	1	2	3	10	5	7

Using rank correlation coefficient method, discuss which pair of judges has the nearest approach to common likings in music.

8 Obtain the rank correlation coefficient for the following data : [L5][CO3] **[12M]**

X	68	64	75	50	64	80	75	40	55	64
Y	62	58	68	45	81	60	68	48	50	70

9 Find two regression equations from the following data : [L1][CO3] **[12M]**

X	10	25	34	42	37	35	36	45
Y	56	64	63	58	73	75	82	77

10 Calculate the correlation coefficient for the following heights(in inches) of fathers(X) and their sons(Y) [L5][CO3] **[12M]**

X	65	66	67	67	68	69	70	72
Y	67	68	65	68	72	72	69	71

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UNIT –IV
APPLIED STATISTICS

<table>
<tr><td>1</td><td>a)By method of least squares fit a straight line to the following data ;
<table>
<tr><td>X</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>y</td><td>14</td><td>27</td><td>40</td><td>55</td><td>68</td></tr>
</table></td><td>[L1][CO4]</td><td>[6M]</td></tr>
<tr><td></td><td>b)Fit a second degree polynomial to the following data by method of least square
<table>
<tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>y</td><td>1</td><td>1.8</td><td>1.3</td><td>2.5</td><td>6.3</td></tr>
</table></td><td>[L1][CO4]</td><td>[6M]</td></tr>
<tr><td>2</td><td>a) Fit a parabola to the data given below
<table>
<tr><td>X</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>Y</td><td>10</td><td>12</td><td>8</td><td>10</td><td>14</td></tr>
</table></td><td>[L3][CO4]</td><td>[6M]</td></tr>
<tr><td></td><td>b) Obtain a relation of the form $y = ab^x$ for the following data by method of least squares
<table>
<tr><td>X</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>Y</td><td>8.3</td><td>15.4</td><td>33.1</td><td>65.2</td><td>127.4</td></tr>
</table></td><td>[L3][CO4]</td><td>[6M]</td></tr>
<tr><td>3</td><td>a) Find the curve of best fit of the type $y = ae^{bx}$ to the following data by method of least squares
<table>
<tr><td>X</td><td>1</td><td>5</td><td>7</td><td>9</td><td>12</td></tr>
<tr><td>Y</td><td>10</td><td>15</td><td>12</td><td>15</td><td>21</td></tr>
</table></td><td>[L1][CO4]</td><td>[6M]</td></tr>
<tr><td></td><td>b) Fit a straight line $y = ax + b$ for the following data
<table>
<tr><td>X</td><td>6</td><td>7</td><td>7</td><td>8</td><td>8</td><td>8</td><td>9</td><td>9</td><td>10</td></tr>
<tr><td>Y</td><td>5</td><td>5</td><td>4</td><td>5</td><td>4</td><td>3</td><td>4</td><td>3</td><td>3</td></tr>
</table></td><td>[L3][CO4]</td><td>[6M]</td></tr>
<tr><td>4</td><td>a) Fit a $y = ax^b$ to the following data, also calculate $y(2.5)$
<table>
<tr><td>X</td><td>1</td><td>2</td><td>4</td><td>6</td></tr>
<tr><td>Y</td><td>6</td><td>4</td><td>2</td><td>2</td></tr>
</table></td><td>[L1][CO4]</td><td>[6M]</td></tr>
<tr><td></td><td>b) Fit a parabola to the following data by method of least squares ;
<table>
<tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>Y</td><td>1</td><td>5</td><td>10</td><td>22</td><td>38</td></tr>
</table></td><td>[L1][CO4]</td><td>[6M]</td></tr>
<tr><td>5</td><td>a)A sample of 400 items is taken from a population whose standard deviation is 10. The mean of the sample is 40.Test whether the sample has come from a population with mean 38.</td><td>[L4][CO4]</td><td>[6M]</td></tr>
<tr><td></td><td>b) The means of two large samples of sizes 1000 and 2000 members are 67.5inches and 68.0 inches respectively. Can the samples be regarded as drawn from the same population of standard deviation 2.5 inches .</td><td>[L2][CO4]</td><td>[6M]</td></tr>
<tr><td>6</td><td>a) It is claimed that a random sample of 49tyres has a mean life of 15200 km. This sample was drawn from a population whose mean is 15150kms and standard deviation of 1200 km. Test the significance at 0.05 level.</td><td>[L4][CO4]</td><td>[6M]</td></tr>
</table>

	b)Samples of students were drawn from two universities and from their weights in kilograms, mean and standard deviations are calculated and shown below. Make alarge sample test to test thesignificance of the difference between the means. | | Mean | S.D | Size of the sample | | University A | 55 | 10 | 400 | | University B | 57 | 15 | 100 |	[L4][CO4]	**[6M]**
7	a) In a random sample of 125 cool drinkers 68 said they prefer thumsup to pepsi. Test thus null hypothesis $P = 0.5$ against the alternative hypothesis is $P > 0.5$	[L4][CO4]	**[6M]**
	b) On the basis of their total scores, 200 candidates of a civil service examination are divided in to two groups, the upper 30% and the remaining 70%.consider the first question of the examination. Among the first group,40 had correct answer, whereas among the second group, 80 had correct answer. On the basis of these results, can one conclude that the first question is not good at discriminating ability of the type being examined here?	[L3][CO4]	**[6M]**
8	a) A die was thrown 9000 times and of these 3220 yielded a 3or 4. Is this consistent with the hypothesis that the die was unbiased?	[L4][CO4]	**[6M]**
	b)In two large populations, there are 30%, and 25% respectively of fair haired people. Is this difference likely to be hidden in samples of 1200 and 900 respectively from the two populations?	[L4][CO4]	**[6M]**
9	a)Experience had shown that 20% of a manufactured product is of top quality. In one day's production of 400 articles only 50 are of top quality. Test the hypothesis at 0.05 level.	[L4][CO4]	**[6M]**
	b) A sample of 400 items is taken from a population whose standard deviation is 10.The mean of the sample is 40. Test whether the sample has come from a population with mean 38.Also calculate 95% confidence interval for the population.	[L4][CO4]	**[6M]**
10	a)In a big city 325 men out of 600 men were found to be smokers. Does this information support the conclusion that the majority of men in this city are smokers?	[L2][CO4]	**[6M]**
	b)A sample of 64 students have mean weight of 70 kgs. Can this be regarded as a sample from a population with mean weight 56kgs and standard deviation 25kgs.	[L2][CO4]	**[6M]**

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UNIT-V
TEST OF SIGNIFICANCE

1	a) A sample of 26 bulbs gives a mean life of 990 hours with a S.D of 20 hours. The manufacturer claims that the mean life of bulbs is 1000 hours. Is the sample not up to the standard.	[L4][CO5]	**[6M]**
	b)A pair of dice are thrown 360 times and the frequency of each sum is indicated below: Sum: 2 3 4 5 6 7 8 9 10 11 12 Frequency: 8 24 35 37 44 65 51 42 26 14 14 Would you say that the dice are fair on the basis of the chi-square test at 0.05 level of significant?	[L5][CO5]	**[6M]**
2	To examine the hypothesis that the husbands are more intelligent than the wives, an investigator took a sample of 10 couples and administered them a test which measures the I.Q. The results are as follows: Husbands: 117 105 97 105 123 109 86 78 103 107 Wives: 106 98 87 104 116 95 90 69 108 85 Test the hypothesis with a reasonable test at the level of significant of 0.05 and also calculate F-test.	[L4][CO5]	**[12M]**
3	A random sample of 10 boys had the following I.Q's : 70,120,110,101,88,83,95,98,107 and 100 a) Do these data support the assumption of a population mean I.Q of 100? b) Find a reasonable range in which most of the mean I.Q values of samples of 10 boys lie.	[L1][CO5]	**[12M]**
4	a)Blood pressure of 5 women before and after intake of a certain drug are given below Before: 110 120 125 132 125 After: 120 118 125 136 121 Test whether the significant change in blood pressure at 1% level of significance.	[L4][CO5]	**[6M]**
	b) In one sample of 8 observations the sum of the squares of deviations of the sample values from the sample was 84,4 and in the other samples of 10 observations it was 102.6. Test whether this difference is significant at 5% level	[L4][CO5]	**[6M]**
5	Two random samples reveal the following results: Sample 1: Size 10, Sample Mean 15, Sum of squares of deviations from the mean 90 Sample 2: Size 12, Sample Mean 14, Sum of squares of deviations from the mean 108 Test whether the samples came from the same normal population.	[L4][CO5]	**[12M]**
6	The nicotine in milligrams of two samples of tobacco were found to be as follows. *Sample A*: *24* *27* *26* *21* *25* --- *Sample B*: *27* *30* 28 *31* *22* *36* Can it be said that the two samples have come from the same normal population.	[L2][CO5]	**[12M]**

7 a) A die is thrown 264 times with the following results. Show that the die is biased. (ψ^2 = 11.07 at 5 d.f & 5% L.S) [L2][CO5] **[6M]**

Number on the die	1	2	3	4	5	6
Frequency	40	32	28	58	54	52

b) Scores obtained in a shooting competition by 10 soldiers before and after intensive training are given below: [L4][CO5] **[6M]**

Before	67	24	57	55	63	54	56	68	33	43
After	70	38	58	58	56	67	68	75	42	38

Test whether the intensive training is useful at 0.05 level of significance.

8 a) Find the maximum difference that we can expect with probability 0.95 between the mean of samples of sizes 10 and 12 from a normal population if their standard deviations are found to be 2 and 3 respectively. [L1][CO5] **[6M]**

b)The following table gives the classification of 100 workers according to sex and nature of work. Test whether the nature of work is independent of theworker (ψ^2 = 3.84 at 1d.f) [L4][CO5] **[6M]**

	Stable	Unstable	Total
Males	40	20	60
Females	10	30	40
Total	50	50	100

9 a) Samples of two types of electrical light blubs were tested for length of life and following data were obtained [L2][CO5] **[6M]**

	Type I	Type II
Sample numbers	8	7
Sample mean	1234 hrs	1036 hrs
Sample S.D	36 hrs	40 hrs

Is the difference in the means sufficient to warrant that type I is superior to type II regarding length of life

b)The number of automobile accidents per week in a certain community are as follows: 12, 8, 20, 2, 14, 10, 15, 6, 9, 4. Are these frequencies in agreement with the belief that accident conditions were the same during this 10 week period. [L2][CO5] **[6M]**

10 From the following data, find whether there is any significant liking in the habit of taking soft drinks among the categories of employees. [L1][CO5] **[12M]**

	Employees		
Soft Drinks	Clerks	Teachers	Officers
Pepsi	10	25	65
Thums up	15	30	65
Fanta	50	60	30

Prepared by: Dept. of Mathematics